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# SUGGESTED PLAN FOR RADIOACTIVE TRACING OF BED LOAD IN THE RIVER STUNG SEN IN CAMBODIA

Note by the
International Atomic Energy Agency

## I. INTRODUCTION

During a meeting in Bangkok in November 1961 between two staff members of the International Atomic Energy Agency and staff members of the Mekong Committee the sediment problems of the Tonle Sap - Great Lake were discussed. From various reports and preliminary investigations the following conclusions can be drawn.

(a) The people in the area think that the Great Lake is rapidly silting up, but there is no evidence whatsoever which supports this view. There are, however, navigational difficulties present in the south eastern part of the lake due to sand and silt barriers.

(b) These barriers can possibly originate from bed load transport by the tributary Stung Sen which empties into the lake in this area and which is known to carry rather coarse sediments.

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As an outcome of the discussion it was suggested that a study of bed load movement of the Stung Sen should be made using radioactively tagged material, if possible in such a way that a quantitative estimate of the transport could be done.

Studies of bed load motion in rivers have been done earlier and apart from the well-known study in the Thames estuary two French studies are worth recalling, one done in the river Rhone in France, the other in the river Niger in Nigeria. Apart from these, estuarine studies of bed load movement have also been carried out in India. There is, thus, at present considerable experience gathered in such work. Laboratory studies on the quantitative aspects have also been done using similar techniques and quantitative studies on a semi-field scale will shortly be undertaken.

II. PLAN OF WORK

In view of the preparatory work needed to carry out such experiments and in view of the fact that precise information on width, depth, size distribution of bed sediments, etc. for the Stung Sen itself is not available it is suggested that the experimental programme be carried out in two stages.

The first stage should take place in August or September 1962 while the discharge rate of Stung Sen is relatively high. Its aim is to provide missing data to give certain qualitative results, to test out the detection and immersion equipment and to establish the base for preparation of a detailed working plan for the second stage.

The second stage should start in May 1963 and should aim at quantitative results.

(a) First stage

In this stage 350 g Iridium-192 labelled sand 0.2 -0.4 mm diameter, total activity 2 curies, is to be used together with 35 g tantalum glass of 200 millicurie activity. The latter will provide a check on the possibility

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of using double labelling to study different size fractions of the bed load material. The tagged material will be placed on the river bed at a suitable location and the transport and dilution downstream will be followed with time by the use of scintillation probes dragged along the bottom, a detector and a recorder of the activity measured. During this time core samples from the bottom will be taken and examined to see to what depth the radioactive grains penetrate. In this way the depth of the moving layer is determined and, knowing the average displacement an estimate of the transport rate of bed material can be done.

During this stage useful experience will be gained to allow a proper planning of the second stage.

Three experts are needed during this stage which will last 2 months. One should be an engineer with good experience in hydrology and he should arrive in Cambodia one month in advance of the experiment to survey the river and the river bed. For this work he needs, of course, a boat and a crew and the boat should be equipped with an echo type depth recorder for surveying the topography of the bottom. He will also take bottom samples to examine the texture and finally decide on a suitable point for release of the tracer.

The other two experts will spend two months in the area. One of them should be an engineer in radiochemistry, familiar with handling radioisotopes in the field. The other should be an electronic engineer responsible for maintenance of the detection and recording equipment.

Apart from the detection and recording equipment, containers for the labelled sand and a system of immersion of the labelled sand has to be provided. It is suggested that the tracer material be obtained from and irradiated in France. In view of French experience, they should also undertake the design and construction of transport and immersion equipment. On the boat to be used a winch is required for lowering the immersion equipment and the containers into the water.

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In the cost estimates given below it is envisaged that two of the experts are recruited in Europe and one in India. The cost of immersion system and tracer are based on the assumption that they are produced in France. In the case of detection equipment the company SRAT, 41 Rue Emerian, Paris XVe, has recently marketed a suitable all-transistorized unit which would be suitable for the project. Two such units have been listed as a spare one is needed in case of breakdown.

For other equipment a core-sampler is listed and a collimator for the detector probe to be used in connection with core sampling.

BUDGET (in US$)

| | | | |
|---|---|---|---|
| Staff (based on a daily fee of $30 and subsistence of $20) | | | |
| 1 hydrological engineer | 3 months | 4500 | |
| 1 radiochemical engineer | 2 months | 3000 | |
| 1 electronic engineer | 2 months | 3000 | 10500 |
| Travel cost to and from Cambodia plus local transport | | | 3300 |
| Locally recruited | | | |
| 1 pilot for the boat | | | |
| 1 assistant to the pilot | | | |
| Equipment for experiment | | | |
| 3 containers for radioactive sand | | 750 | |
| 1 immersion head | | 200 | |
| 1 detector with long distance probe | | 1600 | |
| 1 detector with long special probe (3 scintillator probes) | | 2400 | |
| 1 portable battery operated recorder | | 1600 | |
| 1 spare battery ) 1 battery charger) for recorder | | 200 | |
| 1 core sampler | | 100 | |
| 1 collimator | | 100 | |
| Accessories abt. 10% of equipment | | 700 | 7650 |
| | | carried forward | 21450 |

| | | |
|---|---|---|
| brought forward | | 21450 |
| Equipment for protection | | |
| Individual: 10 pocket dosimeters plus 1 charger | 400 | |
| Group: 1 dose indicator | 300 | 700 |
| Expendable supplies | | |
| Tracer, labelled sand | 50 | |
| Irradiation | 100 | |
| Miscellaneous | 200 | |
| Petrol for boat (local) | | |
| Rent of boat (local) | | |
| Transport cost of equipment | 500 | 850 |
| Total (except local cost) | | 23000 |

(b) Second stage

In this stage to start in May 1963, 2.0 kg of labelled sand containing 5 curies of Iridium-192 in 0.3 - 0.4 mm diameter size is to be used. If experience from the first stage is favourable 350 g of tantalum-glass containing a total of 5 curies, size range 0.2 - 0.3 mm diameter grains will also be used to see how far different fractions of bed material are transported. Otherwise the same programme of detection and core sampling will be done through a total period of 6 months. Only the hydrological engineer would need to stay for that long, the others for only 3 months each.

Budget

| | | |
|---|---|---|
| Staff | | |
| Experts 10 man/months | 15000 | |
| Travel to and from Cambodia | 320 | |
| Local transport | 100 | 18300 |
| Boat crew (local) | | |
| Additional equipment | | |
| 8 containers for radioactive sand | | 2000 |
| Expendable supplies | | |
| Tracer, labelled sand | 750 | |
| Irradiation | 450 | |
| Transport of equipment and material | 500 | 1700 |
| Total (except local) | | 22000 |

TOTAL COST FOR PROJECT $ 45.000